UNIVERSITY OF BIRMINGHAM | SCHOOL OF PHYSICS AND ASTRONOMY

University of Birmingham simulations update

P.P. Allport, L. Gonella, P. Ilten, P.G. Jones, P.R. Newman, H. Wennlöf

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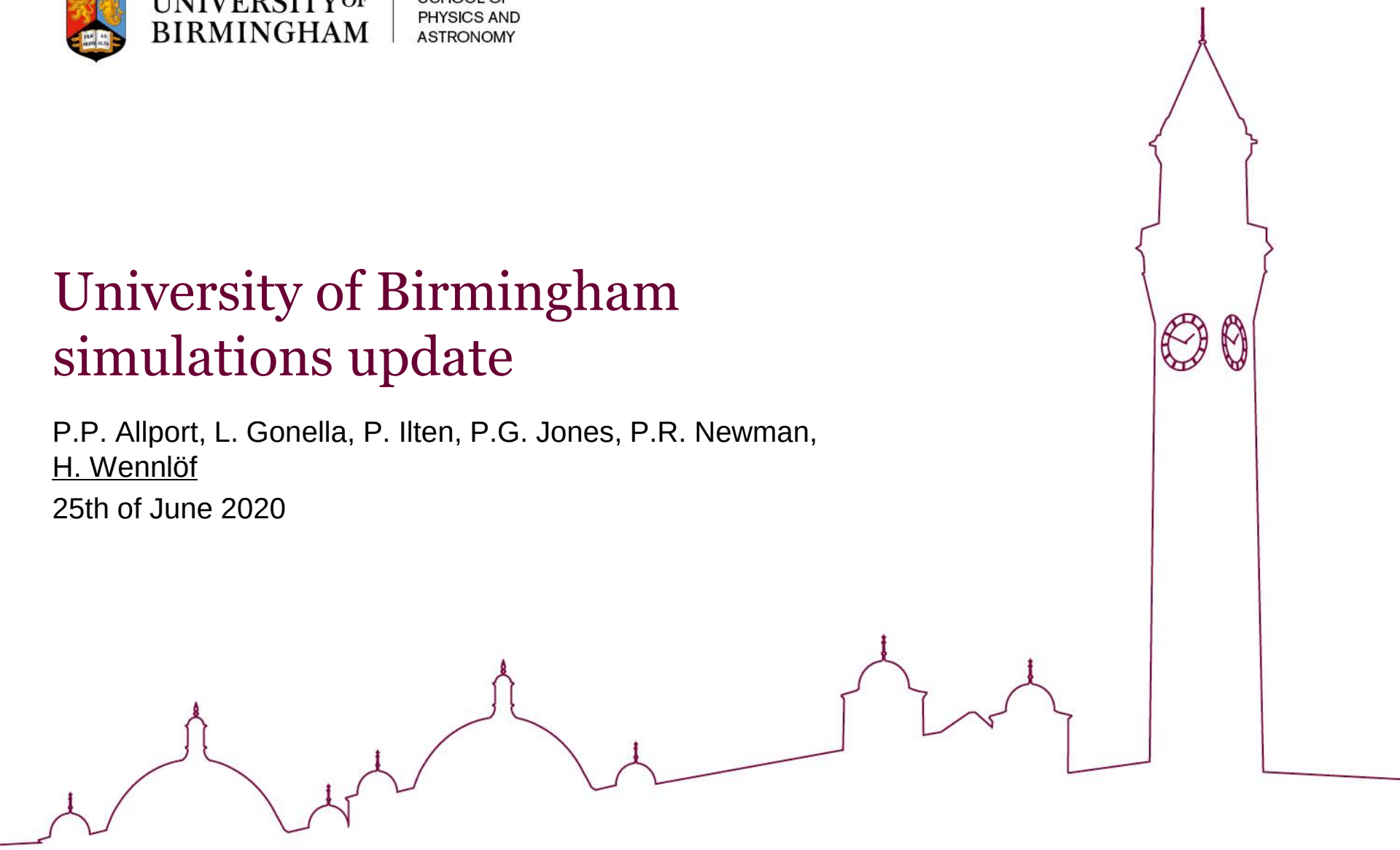
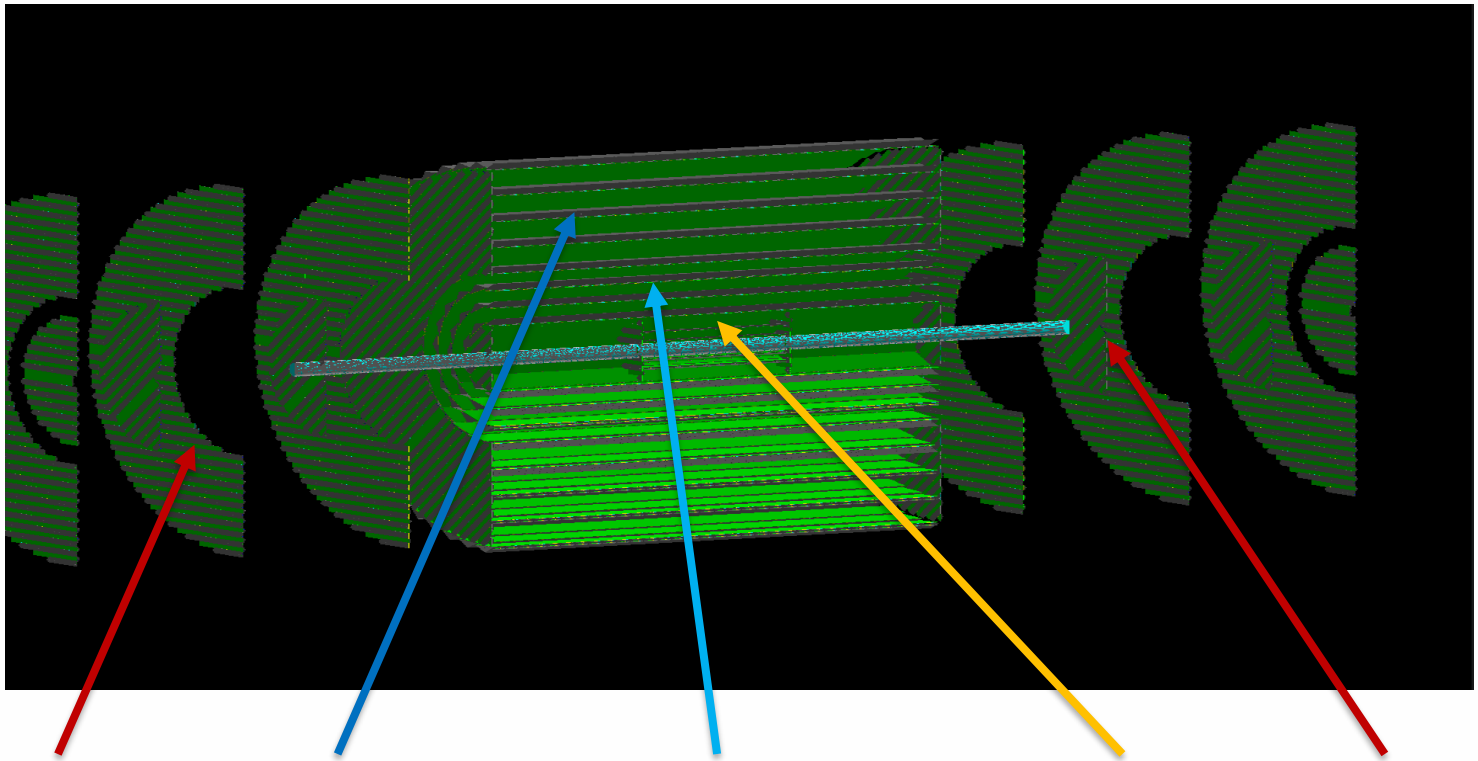


Fun4All – GDML import

- Thanks to Jin, Alexander, and Rey for helping with this
- EICROOT set up to export geometry pieces as GDML files
  - One file for each subdetector part, see next slide
- Possible to import the exact EICROOT geometries used into new framework, thus using EICROOT as a “scripting tool” for easily generating layouts

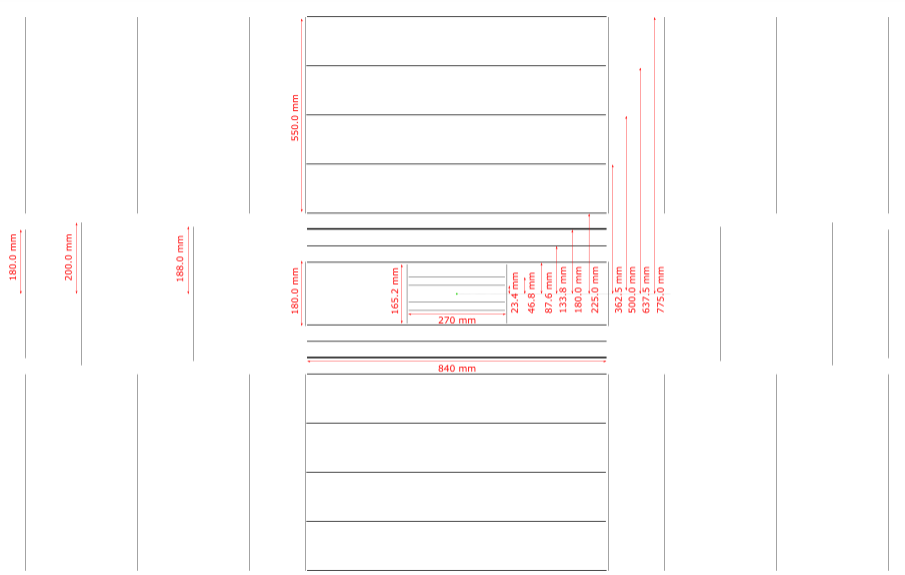
Fun4All – GDML import



- Bst.gdml Sitpc.gdml TimeStamping.gdml Vst.gdml Fst.gdml
- Beampipe 18 mm radius 0.8 mm thick beryllium, as in EICROOT. Study done in central region.
- Set up in a modular way, easy to turn on/off detectors

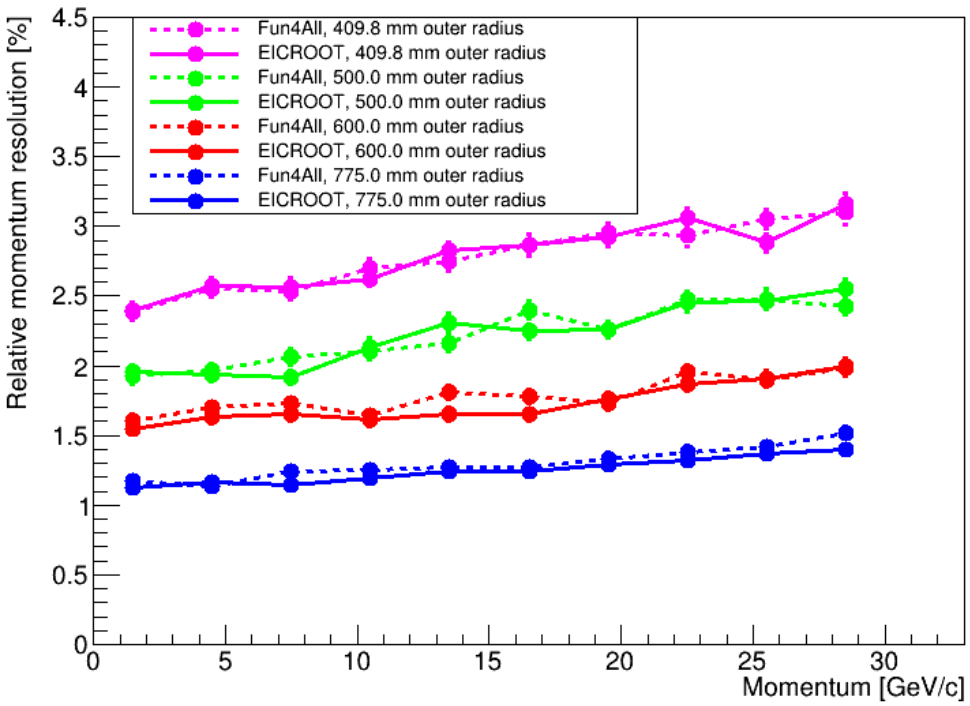
EICROOT benchmarking

- Using a previous study in EICROOT:
  - Export GDML geometry, and import into Fun4All
  - Generate particles in same parameter space
  - Run same analysis code on output
  - Compare results
- All-silicon, varying outer radius study used
  - Details: http://cern.ch/go/xKk6



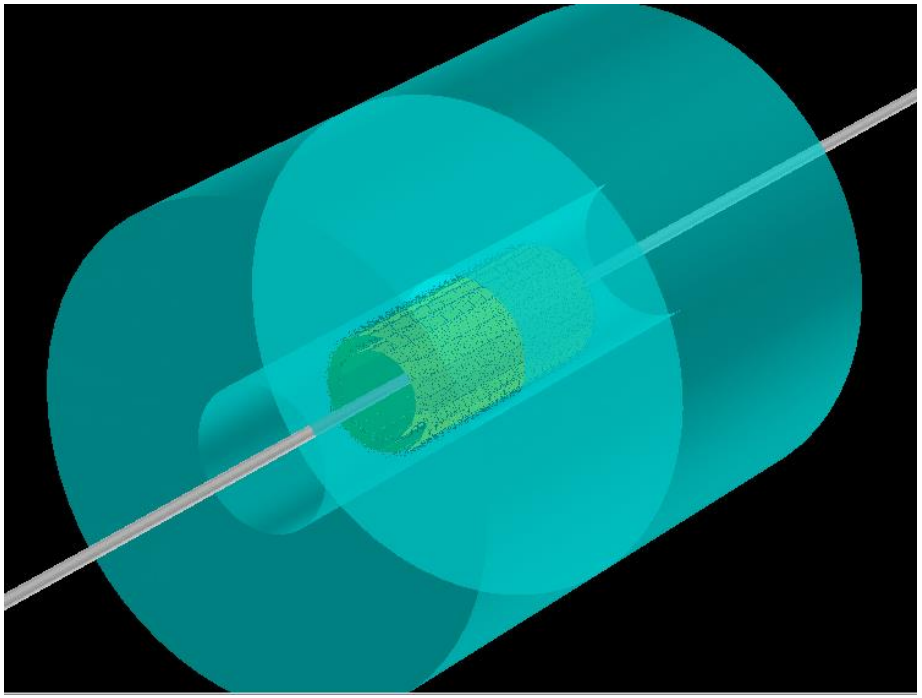
EICROOT benchmarking – initial results

- Relative momentum resolution studied
- Different outer radii used;
  - 409.8 mm
  - 500.0 mm
  - 600.0 mm
  - 775.0 mm
- **No significant difference** between results from the different frameworks
- Gives confidence that both old and new studies are relevant



Comparing ITS2-like to ITS3-like

- Comparing sensor technology possibilities in new layout
  - New beampipe
  - 3 inner layers
  - 2 outer layers
  - Gas TPC outside
- ITS2-like:
  - 20x20 μm^2 pixel size
  - Inner layers: 0.3% X_0
  - Outer layers: 0.8% X_0
- ITS3-like:
  - 10x10 μm^2 pixel size
  - Inner layers: 0.05% X_0
  - Outer layers: 0.8% X_0

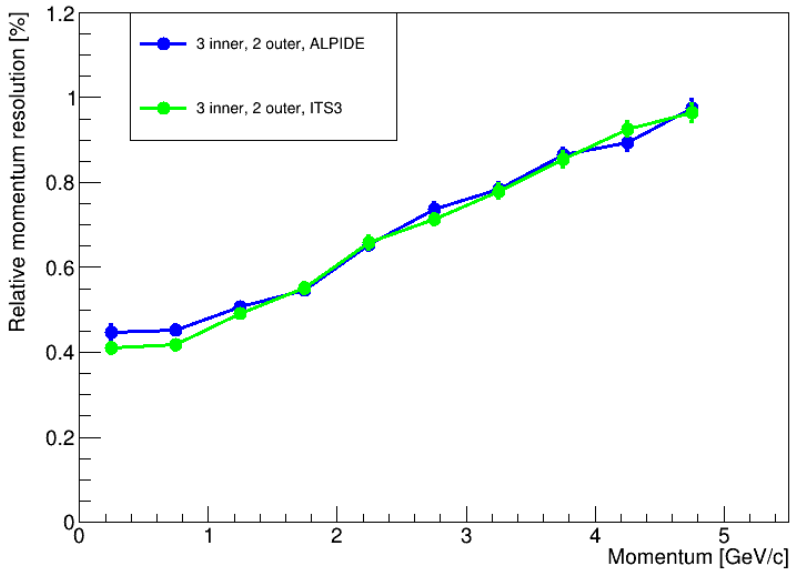


Comparing ITS2-like to ITS3-like

- Parameters used:
  - Particle: π+
  - Transverse momentum range: 0 to 5 GeV/c
  - Pseudorapidity range: -0.5 ≤ η ≤ 0.5
  - Magnetic field: uniform 1.5 T
  - Standard EICROOT gas TPC

- No significant difference in relative momentum resolution

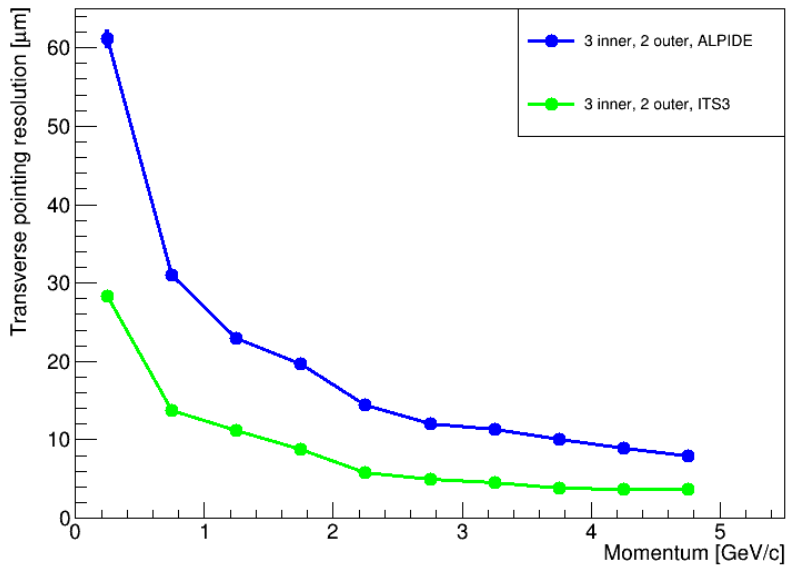
Relative momentum resolution



Comparing ITS2-like to ITS3-like

- Transverse pointing resolution vastly improved using ITS3-like design
- Small pixel size and low material both improve the resolution
- At higher momenta difference is a factor 2, as expected when changing pixel size by a factor of 2

Transverse pointing resolution



Comparison to old baseline

- Checking against the resolution using the ”old baseline” and old beampipe (green curve here)
- New beampipe radius degrades pointing resolution, **however**, using ITS3-like vertexing layers, the resolution is comparable

Transverse pointing resolution